What is claimed is:

1. A method of synchronizing the operation of first and second quantum key distribution (QKD) stations of a QKD system, comprising:

a) establishing in each QKD station respective receive and transmit time domains that are connected between the QKD stations via a timing channel;

b) transmitting from the first station to the second station quantum signals emitted by a laser source over a quantum channel connecting the first and second stations;

c) transmitting optical synchronization signals over a timing channel connecting the first and second QKD stations from respective optical transmitters and over the timing channel, without interrupting the transmission of the quantum signals;

d) forming the optical synchronization signal to include frame sync pulses and data pulses; and

e) coordinating transmission of the quantum signals, encoding of the quantum signals and detecting of the encoded quantum signals by locking the receive and time domains of the two QKD stations using the optical synchronization signals in order to establish a key between the two QKD stations.

2. A method according to claim 1, including multiplexing the quantum signals and sync signals onto a common transmission medium linking the first and second QKD stations.

3. The method of claim 1, wherein forming the optical sync signals includes:

a) generating an electrical sync signal from an FPGA; and

b) receiving the electrical sync signal at an optical transmitter; and

c) converting the electrical sync signal to the optical sync signal.

4. The method of claim 1, including sending the sync signals between a first optical modem in the first QKD station and a second optical modem in the second QKD station, wherein the first and second optical modems each have an optical transmitter and an optical transceiver coupled to a circulator, and wherein the circulators are connected to the timing channel.

5. The method of claim 4, including coordinating the operation of the optical transmitters and optical receivers in the first and second modems with first and second

phase-lock loops (PLLs) in the first optical modem, and a third PLL and a transmit clock in the second optical modem.

6. The method of claim 1, wherein encoding the quantum signals includes:
   a) generating random numbers from a random number generation unit having a plurality of data sources that generate data and that are coupled to a data source selector;
   b) selecting one of the data sources using the data source selector; and
   c) delivering the data from the selected data source to a modulator driver.

7. The method of claim 6, wherein a modulator is coupled to the modulator driver, and including:
   a) providing a gating signal to the modulator driver that coordinates the activation of the modulator driver with the arrival of one of the quantum signals at the modulator based on the synchronization signals; and
   b) encoding the quantum signal with the modulator.

8. The method of claim 1, wherein transmitting the quantum signals includes:
   a) forming from the quantum signal first and second quantum pulses at the first QKD station and transmitting the quantum pulses over the quantum channel to the second QKD station;
   b) at the second QKD station, randomly modulating one of the quantum pulses and attenuating the quantum pulses to form weak quantum pulses;
   c) sending both pulses to back to the first QKD station via the quantum channel; and
   d) randomly modulating the unmodulated pulse at the first QKD station.

9. The method of claim 1, wherein transmitting the quantum signals includes:
   a) at the first QKD station, forming from each quantum signal first and second weak pulses, randomly modulating the first weak pulse and transmitting the modulated first weak pulse and the unmodulated second weak pulse over the quantum channel to the second QKD station; and
   b) at the second QKD station, modulating the second weak pulse and combining the now-modulated first and second weak pulses.

10. The method of claim 1, including electronically adjusting the transmitting and receiving domains in each QKD station to compensate for time delays introduced in at least one of the quantum channel and timing channel.

11. A QKD system having first and second QKD stations, wherein each QKD station includes:

a) a quantum transceiver coupled to a quantum channel, the quantum transceiver having a modulator driver and a modulator, and adapted to transmit and/or receive quantum signals over the quantum channel;

b) a random number generator (RNG) unit coupled to the quantum transceivers, the RNG unit adapted to provide random numbers to the quantum transceiver so as to randomly encode a quantum signal passing through the modulator;

c) a public data transceiver (PDT) coupled to the RNG unit, the quantum transceiver and to a public channel;

d) an optical modem adapted to send and receive optical synchronization signals over a timing channel, the optical modem having an optical receiver and an optical transmitter both coupled to a circulator, which is coupled to the timing channel; and

e) a controller coupled to optics layer, the RNG unit and the optical modem, wherein the controller in one QKD station is adapted to synchronize the operation of the quantum transceiver and the RNG unit in the one station to the quantum transceiver and RNG unit of the other QKD station based on synchronization signals communicated between the controllers through respective optical modems via the timing channel without interrupting the transmitting and/or receiving of quantum signals over the quantum channel.

12. A timing system for a QKD system having first and second QKD stations each having a quantum transceiver, the system comprising:

a) an optical modem in each QKD station, wherein each optical modem has circulator coupled to a transmitter, a receiver, and a timing channel;

b) wherein one of the optical modems includes first and second phase lock loops (PLLs) coupled to the optical receiver and the optical transmitter located therein;

c) wherein the other optical modem includes a third PLL coupled to the optical receiver therein, and a clock coupled to the optical transmitter therein; and

d) a controller in each QKD station and coupled to the optical modem in the corresponding station, the controller being adapted to transmit and receive

synchronization signals over the timing channel and through the optical modems to synchronize the operation of the quantum transceiver, wherein the synchronization signals include frame sync pulses and data pulses.

13. A QKD system comprising:

a) first and second QKD stations each having a quantum transceiver, a random number generator (RNG) unit, a public data transmission unit, an optical modem, and a controller, all operably interconnected within each QKD station;
b) a quantum channel connecting the quantum transceivers;
c) a public channel connecting the public data transmission units;
d) a timing channel connecting the optical modems; and
e) wherein the optical modems transmit and receive synchronization signals having frame sync pulses and data pulses that act to lock a receive time domain to a transmit time domain in each QKD station.

14. The QKD system of claim 13, wherein the timing channel and the public channel share a single physical connection between the two QKD stations.

15. The QKD system of claim 13, wherein the QKD system operates as a two-way system.

16. The QKD system of claim 13, wherein the QKD system operates as a one-way system.

17. The QKD system of claim 13, wherein one of the optical modems includes two phase lock loops and the other optical modem includes a phase lock loop and a clock that generates a synchronization signal.

18. The QKD system of claim 13, wherein synchronization of the QKD stations is controlled by the controller of either QKD station.